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The Dictator and the Parties: A Study on Policy Co-operation in Mineral Economies

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Abstract

This paper develops a game to study the possibility of co-operative behaviour in a situation where the political system is dominated by two strong, opportunistic parties competing in an economy highly dependent on the export of a commodity. Since a binding agreement as an external solution is unlikely to succeed due to the close association between the incumbent party and the government (the guardian), the paper explores the extent to which co-operation between political parties that alternate in office can rely on self-enforcing strategies to provide an internal solution. For appropriate values of the probability of re-election and the discount factor, it is possible to rely on reciprocity to sustain an early-stopping equilibrium. However, co-operation is undermined by low values of re-election probability out of current revenues and party myopia. In those circumstances, the self-policing solution might not be viable and an institutional response would be necessary. The game also sheds some light on the apparent paradox of situations in some mineral-rich democracies (such as the recent Venezuelan experience) where the enjoyment of considerable external revenues is followed by a period of economic stagnation, a deterioration of political stability, and the surge of a dictatorship threat.

Keywords: Political Economy, Non-cooperative games, Democracy, Mineral Economies, Venezuela

JEL classification codes: O11, N16, C72, H63

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1. Introduction

A standard result of non zero-sum games is that the fewer the number of players, the better the conditions for the emergence of co-operation. When this result is translated into the political arena, a democracy based on electoral competition between two political parties appears as the more favourable case for the development of tacit co-operation between the players. A second basic result is that repetition of the game allows for reciprocity and the emergence of co-operation. When this result is used to analyse political competition, the repeated nature of the electoral process provides the ground for enforcement mechanisms. Hence, if parties do not heavily discount the future the possibility of punishment coming from voters or other parties would allow for co-operation in the politic-economic game.

The primary concern of this paper is to work out the implications of these two general results for co-operative behaviour in a situation where the political system is dominated by two strong, opportunistic parties competing in an economy heavily dependent on the export of a commodity. Non-cooperative behaviour between parties brings about inefficiencies that accumulate at an increasing rate over time and lead to political instability resulting from economic deterioration. The analysis is particularly relevant for mineral economies, in which foreign revenues constitute a significant part of fiscal revenues and where, due to public ownership of the natural resources, such revenues accrues directly to the government

Since a binding agreement as an external solution is unlikely due to the close association between the incumbent party and the government, co-operation prospects may need to rely on self-enforcing strategies to provide a internal solution.[1] The co-operative spirit of the game is given by the preservation of democracy in the long term. The main threat to both parties is the possible intervention of a dictator who will end the democratic game. Here the dictator option is a source of enforcement.[2] The incentives for defection are related to the incumbent's desire to

[1] The internal solution (self-policing) is basic in the sense that understanding the prospects for and obstacles in the way of this solution helps to see what sort of external solution is necessary (Taylor, 1987).

[2] By introducing the dictator as a source of enforcement the paper attaches a positive role to him in a democratic society (of course, his value to society vanishes once he is power!).

secure re-election and the alternative character of the game. The incumbent is tempted to spend the stock of resources currently available to secure the re-election before the other party will.[3]

This game can be located in the literature dealing with sequential games where the main concern is the strategic interaction over a state variable.[4] Regarding the line of research focusing on political economy aspects, an example of this type of game is McKibbin, Roubini and Sachs (1987). The authors, adopting the partisan assumption and exogenous probability of re-election, advance a method of solving linear quadratic two-party games with state variables, but they can only obtain the solution by numerical simulation. Other examples in which the state variable is the public debt are Alesina and Tabellini (1990) and Aghion and Bolton (1990).

The motivation of the paper is the recent experience of Venezuela. The country has been an oil economy since the late 20s when oil displaced coffee as the main export product and source of fiscal revenues. During the second half of the XXth century, oil has represented, in average, 25% of GDP, 80% of export revenues and 70% of fiscal revenues. During the period 1968 until 1992, politics in the country was dominated by a two-party system that was in charge of administering generous oil revenues. The last decade of the last century witnessed the lost of political stability. Since 1998, Colonel Hugo Chávez has been in office with a strong popular support, a high concentration on power and without a political opposition of significance. He is caudillo-type figure who came to scene in 1992 as one of the leaders of a failed coup d'etat during that year. Although the military uprising did not succeed in overthrowing the government, it set in motion a process that undermined severely the traditional parties.[5]

The paper is divided into four main sections. The first one introduces the players, strategies, and the equilibrium concept. The following section is devoted to the analysis of co-operation between both parties defined in terms of the possibility of reaching an early stopping equilibrium

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[3] Another possible source of temptation for the incumbent is to borrow today as much as possible because, due to the alternative character of the game, the borrower may not pay fully for the debt in the future (in political and economic terms). For the analysis of this case see Astorga (1996).

[4] The main sources of application of sequential games in economics have been resource extraction and dynamic duopoly games. See for examples of games of resource extraction Benhabib and Radner (1992), and Dutta and Sundaram (1988). Regarding dynamic duopoly games see Maskin and Tirole (1988a, 1988b), and Fudenberg and Tirole (1991: 528).

[5] For more information about the economic history of the country see Astorga (2000) and references therein.

based on grim strategies. The third section explores some extensions of the model. Finally, some concluding remarks are presented.

2. Description of the game

In this section the players, strategies, equilibrium concept, and the pay-off function of the game are presented, together with an interpretation of the main variables and parameters.

2.1. Players, variables, and parameters

There are two opportunistic parties and a dictator. A party is defined as *opportunistic* if enjoyment of power is its only source of utility and its overriding objective is to maximise the expected discounted gains of being in office.[6] The two parties are called *Party I* (she) and *Party II* (he). Depending on the electoral result, each of them can play one of two roles: *incumbent* or *opposition*. It is assumed that at the beginning of the game Party I is the incumbent and Party II the opposition. During each electoral period the incumbent enjoys K utils. There is no utility for the party in opposition. Previous to the election the incumbent chooses an action x. This action can be interpreted as expenditure in public goods.

The probability of being re-elected $p(x)$ is an increasing function of x. It is assumed that $\frac{\partial p(x)}{\partial x} > 0$ and $\frac{\partial^2 p(x)}{\partial x^2} < 0$. The concavity of $p(x)$ is due to diminishing marginal political returns of expenditure.

Voters are assumed to assess the incumbent performance retrospectively. During the electoral period the utility of the voters is directly related to x. There are N voters (N very large), each of them getting a utility of $V_i(x)$. Their strategy is to co-operate with the incumbent (vote for it) as far as the incumbent performs satisfactorily; otherwise to punish her by electing the opposition party.[7] Issues do not count; only results matter.

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[6] Opportunistic parties do not have an incentive to appropriate part of the rents for themselves, as in the case where parties are selfish. Hence, eventually, voters are going to receive all the rents. This is not a zero-sum game where by repeating elections voters (acting strategically) can increase their benefits by improving their bargaining power. For an example of selfish parties see Freejohn (1986).

[7] Note that when using this strategy, although acting rationally, voters do not make any prediction about the future (or the effects of future policies).

Each electoral period the incumbent receives r units of resources with electoral value. The total amount of revenues accruing to the incumbent during the period is assumed to be known.[8] If she spends this amount, she can get a probability $p(r)$ of re-election whereas if she spends $x = x^e$ she will be certain of being re-elected, that is $p(x^e) = 1$. It is assumed that $r < x^e$. For the case $r >= x^e$, the solution is trivial: the incumbent spends $x = x^e$ in every election and remains in power forever.

Additionally, there is a dictator who is concerned about the depletion of the country's stock of reserves. The probability that a dictator takes over power at time t is a function of the level of reserves W_t. In other words, the probability of his intervention increases at the pace of the depletion of the stock of reserves. Once the dictator intervenes, he stays in power forever. This probability can be expressed as:

$$p(dictator / t) = d(W_t)$$

It is assumed that $d(W_t)$ is a convex function with respect to W_t. That is to say:

$$\frac{\partial d(W_t)}{\partial W_t} < 0 \;\; ; \;\; \frac{\partial^2 d(W_t)}{\partial^2 W_t} > 0$$

The total discount factor is defined as the inverse of the probability of a dictator (political discount) times a constant term m accounting for the incumbent's pure myopia (which is not related to the probability of a take-over).

$$d_t = d(W_t, m) = [1 - p_t(dictator)]\, m$$

Here, a distinction is made between two components of the discount factor. The first one finds its justification and meaning in the political arena, reflecting the chances the incumbent party has to be again in office. In this model, a future enjoyment of power depends on the intervention of the dictator, but it also can be thought as accounting for the intensity of political competition, where the entry of new competitors reduces the future chances each party has to be in office. The second component is included to measure parties' time preferences. It ranges from $m = 0$

[8] This assumption is necessary to make the interaction between the parties tractable. As a consequence, I will abstract from the issue of volatility of external revenues, which is a key feature of many developing economies, and particularly in mineral economies.

(short-sighted incumbent) up to $m = 1$ (far-sighted incumbent). Apart for being more precise about the definition of the discount term in the game, introducing this distinction will facilitate the study of co-operation later in the paper.

$d(W_t, m)$ is a concave function with respect to W_t: $\frac{\partial d(W_t, m)}{\partial W_t} \geq 0$; $\frac{\partial^2 d(W_t, m)}{\partial^2 W_t} \leq 0$

The total discount factor will remain fixed ($d_t = d_{t+1} \ldots = d_{t+n} = \bar{d}_t$) while $x_{t+i} = r$, $i = 1 \ldots n$, that is to say, as long as expenditure equals current revenues.

The equation governing the evolution of the stock of reserves at time *t* is:

$W_{t+1} = W_t + r - x$

For a given W_t, $n = INT\left[\frac{W_t}{(x^e - r)}\right]$ gives the number of consecutive elections that the incumbent can win with certainty. [9]

The following section offers some comments on the meaning and empirical significance of the main variables and parameters of the model, using the Venezuelan experience as a way of illustration.

2.2. Interpretation of parameters values and variables

The probability of re-election is introduced to reflect the uncertainty generated by the electoral result. A given amount of expenditure only leads to a probable electoral result. Possible explanations for this uncertainty are lack of information about voters' preferences (or satisfaction levels with respect to expenditure) or the effects of other variables on voter's decisions (e.g., corruption scandals). Under a competitive two-party system, values of $p(r)$ around 0.5 should be taken as more representative. This is consistent with parties with a real electoral chance.

Current revenues (*r*) can be measured in absolute terms or in relative terms as percentage of average reserves or GDP. As an example, the average amount of external revenues accruing to

[9] *INT[...]* stands for an integer operator.

the government in Venezuela during the 70s and 80s was of about US$12bn per year, which represents US$60bn for an electoral period (of 5 years in this case). Seen in relative terms, for an average value of international reserves for the same period of US$10bn, current revenues represented six times the value of the average stock. When evaluating the electoral value of this amount of revenues the same has to be adjusted, for instance by deducting the service of external debt (e.g., US$3bn per year) and when used to finance expenditure aspects such as the fixed cost of the bureaucracy should be considered.

Finally, in this game the probability of a take-over is negatively related to the stock of reserves. The rationale for this assumption can be presented in two steps. First by pointing out the link between reserves and recession and second by noting the causality between recession and abstention. The line of argument is as follows: a low level of reserves would call for an adjustment programme to be implemented in the coming administration; or, another possibility is that the lower the amount of reserves the greater the chance of a currency crisis, which is generally followed by a recession. Again Venezuela offers examples of both situations. In 1989 a drastic adjustment programme was introduced by the new administration after the depletion of international reserves as the result of electoral-driven policies of the previous incumbent. As an illustration of the latter, in 1983 a massive capital flight forced the government to devalue and implement contractionary measures, which cost the incumbent party its re-election.

Once the country enters in a recession a period of popular discontent is expected which can be expressed as a decline in the support for the established parties and/or in an increase in the abstention rate. This situation can boost the dictator's incentive to intervene, either if he is concerned about the popular clamour or because he associates it with a low level of civil support for the system in case of a take-over. Additionally, a situation of high abstention can also create the conditions for the arrival of new parties with electoral chances. Both final consequences of the drop in reserves can be modelled as an increase in the political discount factor. To complete the definition of the game, the players' strategies and payoff functions have to be specified. This is next.

2.3. Strategies and equilibrium concept

Suppose that the game begins in period 0, with the null history h^0. For $t > 1$, let $h^t = \{x^0, x^1, \ldots, x^{t-1}\}$ be the realised choices of actions at all electoral periods before t, and let $H^t = (X)^t$ be the space of all possible period-t histories. I will restrict the attention to strategies in which the past h^t influences current decisions x_i only through its effect on the state variable (W_t), which summarises the direct effect of the past on the present environment. This class of strategies are called *Markov strategies*. So a pure strategy s_i for player i ($i=I,II$) is a sequence of maps s_i^t - one for each electoral period- from values of the state variable at time t (W_t) into the action set of spending decisions X (i.e., $s: W \rightarrow X$). A *Markov perfect equilibrium* is a profile of Markov strategies (s_I^*, s_{II}^*) that yields a Nash equilibrium in every proper subgame. This equilibrium concept has the property of being empty-threat proof because each player's strategy is the best response for every possible state.

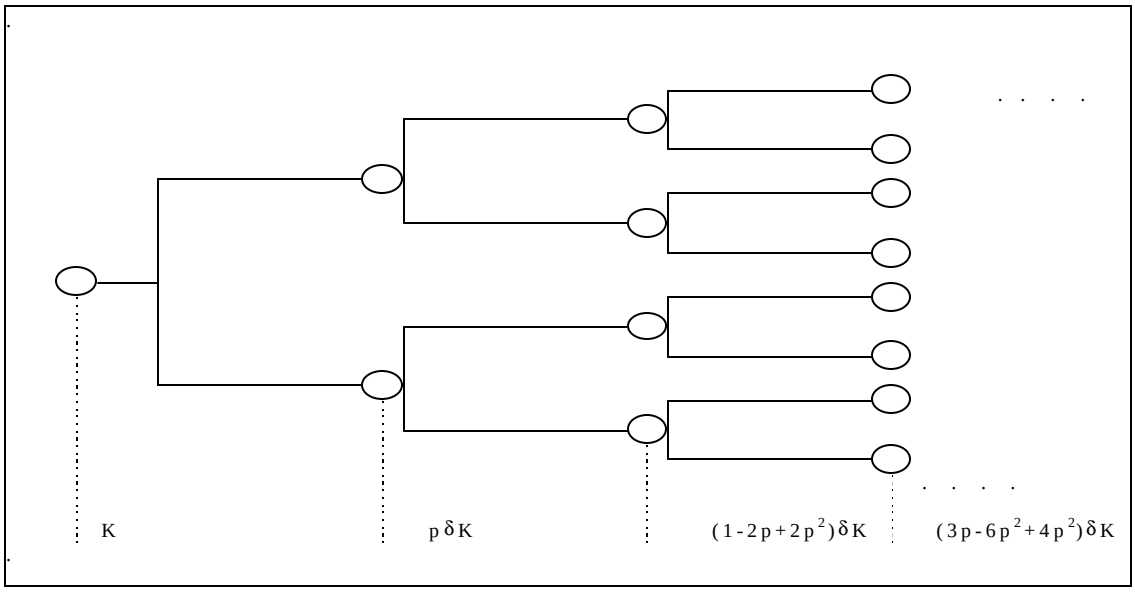
In this game *grim strategies* will be used to explore the possibility of "early-stopping" equilibrium, which will be associated with co-operative behaviour between both players. These strategies are of the form: 'Play $x_t = r$ in period t, and continue to play $x_t = r$ so long as the realised action in the previous period x_{t-1} was r. If not, play the *minimax strategy* for the rest of the game, that is to say, try to secure as many elections as possible.[10]

2.4. Payoff functions

The payoff function is $\sum_{t=0}^{\infty} m^t g(W_t, x_0 \ldots x_t)$, which given the assumptions stated before becomes $\sum_{t=0}^{\infty} m^t p(x_0 \ldots x_t) \delta_t(W_t) K$. The following probability tree depicts the structure of the payoff during a sequence of electoral periods. For the sake of simplicity in the representation, p and the discount factor are assumed to be constant, which is only true in a particular situation when a stationary state has been reached.

[10] By playing minimax the incumbent (Player I) plays the best response assuming that the opposition party (Player II), once in office, will play that strategy that gives the worse result for her. That is, player II will try to minimise player I's pay-off once he has the turn to play. Under this assumption, the best that Player I can do while she has the turn to play is to minimise the chances of Player II getting into office (consequently, minimising the opposition party's pay-off).

Figure 1: Probability tree of electoral gains



The development of the payoffs during electoral periods is:

$$I^1 = K[1 + pd + (1-2p+2p^2)d^2 + (3p - 6p^2 + 4p^3)d^3 +$$
$$+ (1-4p+12p^2-16p^3+8p^4)d^4 \ldots (\cong \tfrac{1}{2})d^{m-1} + (\cong \tfrac{1}{2})\frac{d^m}{(1-d)}]$$

At time $t = 0$ (current electoral period), Party I is the incumbent and enjoys K utils. During this period she spends x_0 and obtain a probability of being re-elected p. Thus, during the second electoral period she will be in office (in) with probability p, or in the opposition (out) with probability (1 - p). The expected discounted payoff for this second period is then equal to d [pK + (1 - p)0]. The analysis of the third period includes four possible cases, in two of them Party I is in office with her payoff being equal to d^2 (1 - 2p + 2p^2). For periods occurring far into the future the probability of being in office converges to a half. Also, note that due to the presence of discounting, expected gains get lower as times goes on.

Next the situation depicted by the probability tree will be presented in a more formal manner. In general, at time t the total expected pay-off for the incumbent (Party I) is given by:

(1) $I_t^1 = p(x_t)d_{t+1} I_{t+1}^1 + [1 - p(x_t)]d_{t+1} I_{t+1}^0 + K$

(2) $I_{t+1}^0 = [1 - q(x_{t+1}^{II})]d_{t+2} I_{t+2}^1 + q(x_{t+1}^{II})d_{t+2} I_{t+2}^0$

where: $I_t^1 = I^1(W_t)$; $I_{t+1}^1 = I^1(W_t + r - x_1)$; $I_{t+2}^1 = I^1(W_t + 2r - x_1 - x_2)$

I^0_{t+1} is the expected pay-off for Party I acting as opposition party at time *t+1*

$p(x^I)$ and $q(x^{II})$ mean that Party I and Party II is in office respectively.

Likewise, at time *t* the opposition party (Party II) expects to obtain:

(3) $II^0_t = [1 - p(x^I_{t1})]\delta_{t+1}\, II^1_{t+1} + p(x^I_t)\delta_{t+1}\, II^0_{t+1}$

(4) $II^1_{t+1} = q(x^{II}_{t+1})\delta_{t+2}\, II^1_{t+2} + [1 - q(x^{II}_{t+1})]\delta_{t+2}\, II^0_{t+2} + K$

where: $II^1_{t+1} = II^1(W_{t+1} + r - x_1)$; $II^1_{t+2} = II^1(W_{t+1} + 2r - x_1 - x_2)$

II^0_t stands for the expected gains for Party II being in opposition at time *t*.

An amount of expenditure (*x*) different from current revenues (*r*) has two contrary effects on the incumbent's discounted expected revenues. The first effect is related to the value of the dictator factor. When the incumbent spends more than she receives she finances the extra spending with reserves, otherwise she accumulates reserves. A drop(increase) in reserves increases(decreases) the probability of a dictator's take over and consequently reduces(increases) the expected gains. The second one is linked to the probability of re-election. An increase(decrease) of expenditure over *r* improves(worsens) the incumbent's chances of re-election, and consequently the expected gains, but worsens(improves) the expected pay-off of the opposition party.

Player I(II)'s problem at time *t* is to maximise her(his) expected pay-off, taking into account the decision of Party II(I) in that case where he(she) happens to be in office, subject to the no-borrowing constraint $\sum_{i=1}^{\infty}(x_i - r_i) \le W_0$ and the motion equation $W_t = W_{t+1} + r - x_t$.

Of particular interest for the analysis is the expected pay-offs the incumbent will obtain when the stock reaches a stationary state, i.e., values of the state variable that will be preserved once it is achieved. This resting point corresponds naturally to the economic notion of long-run

equilibrium. Also, as will be presented later on in the chapter, a co-operative behaviour will require that the level of reserves will be kept constant at a certain level. [11]

The stationary state

During the stationary state the incumbent sets $x_t = r . \forall t$, in which case $I_t^i = I_{t+1}^i = I_{t+2}^i ..... = I^{iS}$ for $i = 0$ and 1; $\delta_{t+i} = \delta_{t+i+1} = \delta_s = \delta(W_{t^S,\, m})$ $\forall i$; where the symbol *S* is used to mean stationary state. Also, $p(r) = q(r)$, i.e., it is expected that for a given expenditure both parties will obtain the same probability of re-election and will implement the same strategy once in office. The time t^S at which $x_t = r$, depends on the path followed by the incumbents as reflected in the history of the game h^t.

Regarding the incumbent party at time t^S (which it is assumed to be Party I), the continuation pay-off becomes:

(5) $I^{1S} = p(r)\delta_s . I^{1S} + [1 - p(r)]\delta_s . I^{0S} + K$

$I^{0S} = [1 - q(r)]\delta_s . I^{1S} + q(r)\delta_s . I^{0S}$

(6) $I^{0S} = \dfrac{[1 - q(r)]\delta_s}{[1 - q(r)\delta_s]} I^{1S}$

After substituting (6) into (5), I find the expression for the total expected pay-off for the incumbent party in the stationary state:

(7) $I^{1S} = \dfrac{[1 - p(r)\delta_s]K}{(1 - \delta_s)[1 + \delta_s - 2\delta_s . p(r)]}$

On the other hand, following a similar procedure, I obtain the expected pay-off at time t^S for the party in opposition (Party II).

(8) $II^{0S} = [1 - p(r)]\delta_s . II^{1S} + p(r)\delta . II^{0S}$

$II^{1S} = q(r)\delta_s . II^{1S} + [1 - q(r)]\delta_s . II^{0S} + K$

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[11] Regarding the analysis on uniqueness and stability of the game, it can be shown that there is convergence towards a unique stationary state for the level of reserves (W^E), and that the system is stable in the sense that for an amount of reserves different than W^E, the incumbent changes the level of the stock generating a move in the direction of the equilibrium position. See Astorga, 1996.

$$(9) \quad II^{1S} = \frac{[1-q(r)]d_s . II^{0S} + K}{[1-q(r)d_s]}$$

After substituting (9) into (8), the expression for the total expected pay-off at time t^S for the opposition party is obtained:

$$(10) \quad II^{0S} = \frac{[1-p(r)].d_s K}{(1-d_s)[1+d_s-2d_s p(r)]}$$

Finally, the total discounted pay-off for both parties is given by:

$$I^{1S} + II^{0S} = \frac{K}{(1-d_s)} \quad \text{where} \quad d_s = d(W_{t^S}, m)$$

From this last expression the Pareto-optimum or efficient result for the level of reserves W^P can be derived. This corresponds to the level that make the total discount factor equal to the pure myopia value, i.e., $W^P / d_s(W, m) = m$.

After introducing the game and characterised the non-cooperative equilibrium, the next step is to present the conditions for the emergence of co-operation between both parties.

3. The possibility of co-operation

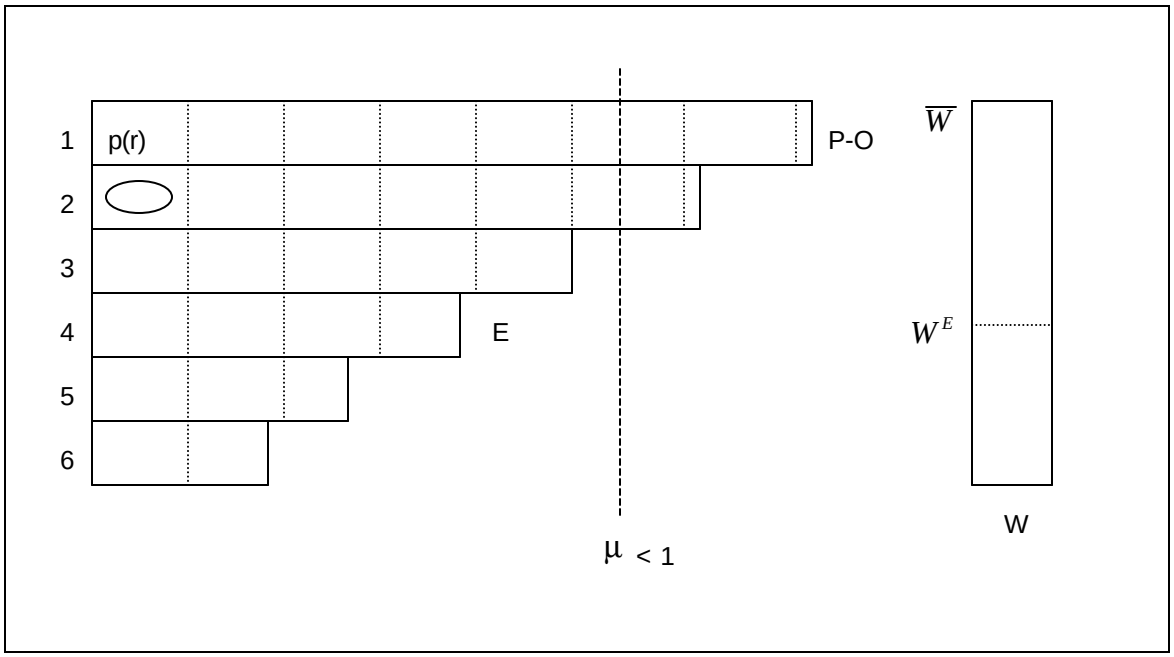
Sequential games differ significantly from repeated games because there is a state variable that changes in response to players' actions. Therefore, whether or not an early-stopping equilibrium[12] can be enforced by using grim strategies depends not only on the discount rate but also on the level of the state variable. In this particular game, the discount factor becomes partially an endogenous variable being determined by the level of reserves. There are mutual gains if both parties decide to co-operate in maintaining or improving the level of reserves and, in that way, reducing the risk of a take over. More generally it provides an illustration of the link between the country's wealth and the incumbent's willingness of postponing consumption when electoral incentives are present. As an illustration of the co-operative problem consider the following metaphor:

"Driving on a highway"

There is a car with two occupants, both wanting to be the driver. They are on a highway with lanes of different length. The driver has an expected driving period equal to *p(r)*, which she can increase(reduce) by moving down(up) to the immediate lane below(above). There are two special lanes in the highway: a lane in which there is no incentive to change (stationary lane), and the longest lane (*Pareto-Optimum*). Due to myopia, the driver might not distinguish lanes of different length, as illustrated in Figure 4 with lanes 1 and 2 at the point marked by the dotted line. For an amount of reserves lower than W^E, the incumbent has the incentive to increase the stock unilaterally and, consequently, to generate a move in the direction of the equilibrium position. By contrast, when the level of reserves is above W^E, the incumbent is tempted to consume part of the stock in order to boost her electoral prospects. This behaviour causes a downward movement towards the stationary lane.

[12] Here associated with an efficient equilibrium of the supergame.

Figure 2: driving on a highway



Two incentives for co-operation can be distinguished:

i) For a given stock of reserves, both parties can co-operate on maintaining constant the probability of a dictator (keep driving in the same lane). In that way they can avoid increasing the risk of the system.

ii) Both parties would be better off if they could co-operate in building up reserves in order to reduce the probability of a take over (moving to a longer lane). But the incumbent will be worse off if, after building reserves, the opposition party wins the election and consumes part of these newly built reserves in order to guarantee his re-election. In both cases, in order to sustain co-operation, the parties may adopt grim strategies that contemplate as a punishment path the reversion to W^E (the stationary lane) as soon as possible.[13]

However, any level of reserves within the interval $[W^E, \overline{W}]$ (i.e., any of the lanes above the stationary one) can be a candidate to be selected as the level to be sustained through co-

[13] It is assumed, as in the case of the supergame, that this threat is always credible (Friedman 1971). So, if a deviant incumbent is re-elected, she will not do better than to implement the punishment first. This, however is a strong assumption because it implies that even after a small deviation has occurred the next incumbent will be willing to carry the punishment through, which would be a unreasonable thing to do. This problem is due to the continuity of the pay-off function that contrast with the supergame case. Within the framework of complete information games this assumption is questionable; a better argument for deterrence against small changes can be found by allowing some elements of irrationality in the game.

operative behaviour. This wide range of possibilities creates a problem of multiplicity of equilibria.[14] In contrast to a situation were both players play simultaneously, in this game the co-ordination problem might not be so serious. The reason is that the incumbent player has a privileged position in the sense of being able to show a commitment to co-operate, which then can be followed by the opposition party once in office. How can a particular level of reserves from this feasible set be chosen as the co-operative stationary state? On what grounds an incumbent decides to choose any particular level? A plausible answer can be given in terms of the presence of a focal point (e.g., an amount of reserves with a salient feature). Also, by considering the internal life of the incumbent party, the selection of a particular level can be linked to the arrival of leadership sympathetic to co-operation.

In what follows I will look for those conditions required to make co-operation of the first type, which is the more basic of the two. The second case will not be considered here. In the latter situation, co-operation is based on the possibility of making sacrifices in the present in order to lengthen the life of the game and requires far sighted parties. However, when myopia dominates, co-operation on piling up reserves is very unlikely to emerge.[15]

3.1. Keeping constant the risk factor in the game

The study of the conditions for the emergence of co-operation is based on the standard procedure that checks for the presence of incentives for defection. The focus is placed on the *Incentive Compatibility Condition* (*ICC*), which consists of the difference between the pay-

[14] The *folk theorem* of repeated games assures that, for a sufficiently small discount rate, any point of the efficient frontier can be sustained as a *subgame-perfect equilibrium.* The good news is that a better result than the inefficient equilibrium can be achieved; the bad news is that any point can be sustained. The resulting multiplicity of equilibria creates a well-recognised co-ordination problem.

[15] This second case is more complicated to treat formally. The analysis could be developed based on the idea that for co-operation of this type to emerge there are two conditions that should be satisfied. In the first place is the f*easibility condition*. It demands that the future benefit of co-operation of an electoral sacrifice has to outweigh the opportunity cost in terms of re-election chances today, assuming that there is no incentive to deviate once a greater level of reserves has been reached. In the second place is the *credibility constraint*. It demands that once the level of reserves is increased, and given that there is any further increase in reserves, the temptation for the next incumbent to deviate (whoever party it will be) cannot be greater than the gains for continuing co-operation. The task, then, is to evaluate if there are values for the parameters such that the build up of reserves is both feasible to be generated by the current incumbent, and credible to be kept by the next one.

off the incumbent expects to receive if she deviates (I^{1D}) and what she will receive if co-operation is maintained (I^{1C}).

In order to obtain the gains of defection, it is assumed that if the incumbent deviates she will try to secure as many elections as possible. Thus the punishment phase is characterised by the implementation of a *minimax* or *myopic strategy* ($s^{m)}$. During the period of deviation (not necessarily equal to one electoral period) the incumbents will increase the pace of expenditure reducing the stock of reserves in W^d equal to $(W_0 - W^E)$, assuming that deviation occurs at $t=0$. By following a myopic strategy, the deviant incumbent will stay in office with certainty n electoral periods.

$$n = INT\left[\frac{(W_0 - W^E)}{(x^e - r)}\right]$$

Assuming that n is an integer, (i.e., that in the period $t = n+1$[16] expenditure will be set at $x=r$) the incumbent expects to obtain a pay-off after defecting equal to:[17]

(11) $I^{1D} = K[1+(d_1)p_e+(d_2)p_e+...]+d_n[I^{1N}]$

being $I^{1N} = \left[\frac{(1-p_r d_N)K}{(1-d_N)[1+d_N-2d_N.p_r]}\right]$

I^{1N} is the expected pay-off for the incumbent party in the stationary equilibrium and $p_e = p(x^e) = 1$ means that the incumbent's re-election is certain. The sequence of discount factors during the deviation period reflects the fall of reserves. They are expressed as:

$$d_1 = d\left[W_0 - (x^e - r), m\right] \; ; \; d_{n-1} = d_{n-2}.d\left[W_0 - (n-1)(x^e - r), m\right] \; ; \; d_n = d_{n-1}.d\left[W^E, m\right]$$

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[16] The subscript $(n+1)$ indicates the electoral period at which the system would rest again in stationary Nash equilibrium if a deviation occurred in the current period.

[17] For the deviant case in which $x_{n+1} > r$, the gains of defection will be greater; therefore, by assuming n as an integer the temptation will be underestimated. However, a probability of re-election at $t=n+1$ different than $p(r)$ will complicate the algebra and clarity of exposition without changing the conclusion of the analysis. The pay-off under deviation for this more general is obtained by developing eq. (1) :

$I^{1D} = K[1+...d_n p_e + d_{n+1}p_d]+(1-p_d-p_r+2p_d p_r)m^{n+1}d_N I^{1N}+(p_d+p_r-2p_d p_r)m^{n+1}d_N I^{0N}$

Where: $p_d = p(x^d) = p(r+\left[W^d - n(x^e - r)\right])$ refers to the probability that the current incumbent will be in office at time $t=n+1$, given that defection has occurred at time $t=0$. x^d stands for the expenditure during the period when reserves reached the equilibrium level.

In comparison, in a situation where parties play co-operatively, the incumbent's expected pay-off is given by:[18]

$$(12)\quad I^{1C} = \left[\frac{(1-p_r d_c)K}{(1-d_c)[1+d_c-2d_c.p_r]}\right]$$

Note that, regarding the incumbent's discounting, a difference is made between three values for the political factor: in the first place, $d_N = d(W^E, m)$ stands for the discount that applies when the system is at stationary equilibrium with reserves equal to W^E; in the second place, the discount factors during the period of deviation during which reserves are falling; finally, $d_c = d(W_0, m)$ is the value for the discount factor under co-operation, assuming that reserves are kept constant at the level shown at $t=0$.[19]

How can co-operation be sustained?

Co-operation can emerge in this game if appropriate values for the parameters of interest (in this case combinations of m and $p(r)$) can be found that makes the gains of co-operation equal or greater than those of defection. To check under which circumstances this is the case, I will study the incentive compatible condition

$$(13)\quad I^{1D} - I^{1C} = 0$$

which, after substituting (11) and (12) and rearranging, results in:

$$(14)\quad (1+d_1\ldots+d_{n-1})+d_n\left[\frac{(1-p_r d_N)}{(1-d_N)[1+d_N-2d_N p_r]}\right]-\left[\frac{(1-p_r d_c)}{(1-d_c)[1+d_c-2d_c.p_r]}\right]=0$$

The *ICC* is expressed as the combination of three terms. The first one is the gains the incumbent expects to receive for remaining in office without interruption after deviation has occurred. This term captures the *temptation* for deviating from co-operation, being positively related to the initial amount of reserves and current revenues. The second term stands for the non co-operative pay-off for the party currently in office from period $t=n+1$ onwards. The third component gives the expression for the incumbent's expected gains under co-operation. The

[18] This expression is obtained following the same procedure employed to obtain eq.(7).

[19] In the particular case where the spirit of co-operation is to minimise the risk of a take over by keeping the level of reserves W equal to $\overline{W}$, the discount factor only accounts for time preferences (i.e., $d_c = m$).

aggregation of the last two terms gives the size of the *enforcement*, which size is considerably affected by discounting, both due to political reasons or time preferences.

The balance between temptation and enforcement determines the prospects for the emergence or break up of co-operation and this balance is the result of a combination of various effects of contrary direction and magnitude. Some calculations based on equation (14) provide useful information about the consequences of changes in the probability of re-election and the level of myopia.

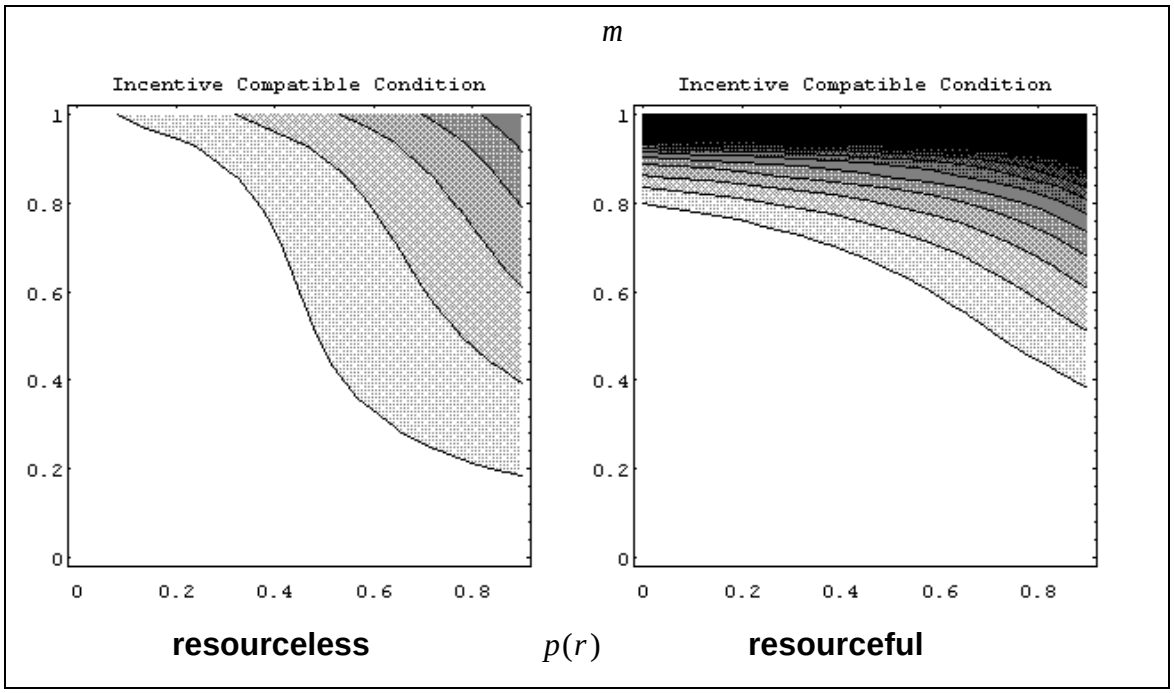
3.2. Two exercises of co-operation

In what follows the results of two calculations based on (14) is presented. [20] They differ in the assumed size of the temptation, that is to say, the stock of reserves above the level of long-run equilibrium at disposition of the current incumbent. The first calculation (shown in Figure 5) assumed that, at $t=0$, the incumbent by defecting has just enough reserves to improve significantly her probability of re-election for a second administration. The second one (Figure 6) reflects a situation in which the electoral value of the stock, if spent, would allows the incumbent to have a very good chance of retaining office during two consecutive periods. The scenario depicted in Figure 5 is consistent with a reasonable initial value of reserves (e.g. enough to cover four month of imports) and a relatively low value of the political discount under co-operation (e.g. d_c = 0.7); whereas Figure 6 is consistent with a high stock of reserves (e.g. eight month of imports) and a very low political discount at $t=0$ (e.g. $d_c \cong 1$). Of the two situations, the former is closer to what might happen in reality while the latter is an extreme case.

In both figures the two-dimensional projection of the *ICC* is plotted for combination of values of $p(r)$ and m. The white area stands for all those values of $p(r)$ and m where temptation exceeds enforcement (values greater than zero). Shadows form the co-operative region, where a move to a darker zone indicates that the co-operative result is less likely to be altered by changes in the parameters of interest.

[20] The figures are generated using the simulation package *Mathematica*.

Figure 3 **Figure 4**



Some conclusions can be drawn from the observation of both figures. Looking at similarities, they show that, for an appropriate discount factor, co-operation can be the result of the game. Incumbent's myopia undermines the incentives for co-operation. They also indicate that the higher the value of current revenues, and consequently *p(r)*, the better the prospects for the emergence of co-operation. In other words, facing an unfavourable external context the incumbent is more willing to break co-operation than in a period of buoyant external revenues. The possibility of defeat weights more heavily than the possibility of undermining the length of the game.

When the attention is focused on differences, the comparison between both calculations shows that when the chances of re-election are low, a resourceful incumbent in order to co-operate demands a lower value of *m* than a poorer one. That is, the resourceless incumbent is more sensitive to myopia than the wealthy one. Conversely, a high amount of current revenues (a high *p(r)*) has a greater effect in improving the conditions for co-operation in a poor incumbent than in a wealthy one. So when the electoral value of the stock is high, co-operation prospects are less sensitive to high levels of current revenues.

A final observation regards the robustness of co-operation. This is represented by the intensity of the gradation from white to black. As the co-operative zone gets darker, co-operation is more robust to small changes in the values of the incentives (values of parameters). This tends to be more the case for the resourceful incumbent than for the poor one. To what extent can the observations derived from the two calculations be generalised? In the absence of an analytical solution to the *ICC*, what can be said is that these patterns can be taken as representative of the behaviour of the co-operative solution of the game. The same qualitative results are obtained in calculations made with intermediate values for the temptation, and in that sense they are robust.

4. Extensions

In this paper the only way of financing expenditure is through own revenues. This is a quite restrictive an unrealistic assumption. For example, external borrowing is an important source to finance deficits. Astorga (1996) works out the implications of the externality nature of borrowing when decisions are made in a political framework characterised by alternation of opportunistic parties. The main insight is that, facing an adverse or an even electoral contest, the incumbent acting unilaterally will be always willing to contract debt to finance projects with high political returns although these may not be justified on economic grounds. Another result indicates that if parties are uncertain at the beginning of the game about who is going to contract and spend the debt, they have an incentive to commit themselves to minimum borrowing. This analysis could also be extended to a model where the state variable is the stock of capital instead of the stock of reserves. However, this situation is of a greater level of complexity than the one studied here due mainly to the reproductive nature of capital and the need to differentiate between current and investment expenditure.

The model also offers some insight to the design of stabilisation funds. Stabilisation funds are an institutional response to deal with external revenue volatility. In the absence of markets to cover the risk involved, this solution implies a rule of saving and expenditure that provides a mechanism of self-insurance. In this way most of the cost associated with stop-and-go economy can be avoided if the economy is isolated from the instability and uncertainty of the main source of income.

One implication of the model presented in this paper is that the optimal response to windfalls based on smoothing via a stabilisation fund would not be compatible with electoral incentives. Given that a condition for the success of such a fund is the possibility of isolating its management from the incumbent's discretion, the alternation of parties in office and the potential electoral value of the resources of the fund, generates a credibility problem. If a centralised decision is not possible because of a problem of the type *who guards the guardian*, then what is left is a self-policing solution. This would imply dealing with the two cases of co-operation presented earlier: building up during good times, and resist temptation to deplete the stock during bad times. Although, as was shown in this paper, tacit co-operation in maintaining a stock of reserves is possible its emergence will be undermined when the incumbent faces drastic fluctuation in current revenues.

5. Final remarks

The basic question addressed in this paper is whether an internal solution exists for the preservation of democracy and the promotion of long-term growth, or if it would require a centralised solution to guarantee formal agreements between both parties. It has been shown that, for appropriate values of the probability of re-election and the discount factor, it is possible to rely on reciprocity to sustain an early-stopping equilibrium. However, co-operation is undermined by low values of re-election probability out of current revenues and party myopia. In those circumstances the self-policing solution might not be viable and an institutional response would be necessary. For instance, this can take the form of delegating the incumbent's authority to an independent agency responsible for stabilising the level of reserves, or the imposition of constitutional restrictions on external borrowing.

Regarding the empirical relevance of this game, despite the use of restrictive assumptions it sheds some light to understand the apparent paradox of some mineral-rich democracies (such as the recent Venezuelan experience) where the enjoyment of considerable external resources was followed by a long period of economic stagnation, a deterioration of the political stability, and the surge of the threat of dictatorship.

Finally a comment on dictators. By introducing the dictator as a source of enforcement the paper gives him a positive role in a democracy. However, the paper does not deal with the

behaviour and results associated with an incumbent dictator. Does the existence of inefficiencies caused by party competition imply that an alternative regime can produce better results? A conclusion in this direction is tempting but may be without sound basis. A real case may be enough to make the point. Contemporary Nigeria offers a notorious example to show what a dictatorship with oil can be. More generally, if the overriding objective of the government is that of regime survival, the nature and amount of inefficiencies might be similar. All regimes require legitimacy to rule, and legitimacy is based on winning political support by granting distributive or re-distributive favours to key groups.[21] The distinctive difference could be that in the case of non-democratic regimes, elections are unlikely events and so are the regularities associated with the electoral timing.

[21] See Ames (1987) for evidence of the inefficiencies associated with the political survival of dictatorships in Latin America.

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